DOI:10.1111/j.1365-2125.2004.02179.x

Influence of socioeconomic status on the quality of prescribing in the elderly – a population based study

Enitan Odubanjo, Kathleen Bennett & John Feely
Department of Pharmacology & Therapeutics, Trinity Centre for Health Sciences, St. James' Hospital, Dublin, Ireland

Correspondence
Kathleen Bennett, Department of Pharmacology and Therapeutics, Trinity Centre for Health Sciences, St. James' Hospital, Dublin 8, Ireland.
Tel: 0035316081303
Fax: 0035314539033
E-mail: bennettk@tcd.ie

Keywords
elderly, pharmacoepidemiology, quality prescribing, socioeconomic status

Received
23 December 2003
Accepted
16 April 2004

Aims
To compare the quantity and quality of prescribing, using prescribing indicators, between the relatively deprived and the relatively affluent patients over 70 years old in primary care.

Methods
We examined the General Medical Services (GMS) scheme prescribing data for the Eastern region in Ireland for all patients aged 70 years or more (n = 95 055) during July 2001–December 2002. Prescribing indicators applied to the prescription data to evaluate drugs prescribed to each patient were classified as: (1) descriptive, e.g. number of drug items/patient; (2) indicators assessing potentially harmful prescribing; (3) evidence-based indicators, e.g. secondary prevention therapy in those with ischaemic heart disease (IHD). Results are expressed as odds ratio (OR) and 95% confidence intervals for comparison of prescribing between the relatively deprived and affluent cohorts, adjusted for age and gender (CI) using logistic regression analysis.

Results
The relatively deprived cohort was more likely to receive a greater number of drugs (5.2 *vs.* 4.5, $P < 0.0001$), more generic products ($P = 0.01$) and be exposed to major polypharmacy (≥ five drugs) compared with monotherapy (OR = 1.58; 95% CI = 1.52,1.64, $P < 0.0001$). They were more likely to receive potentially harmful drugs such as cerebral vasodilators (OR = 1.52; 1.38,1.69), long-acting sulphonylurea (OR = 1.43; 1.20,1.72), potentially interacting agents such as angiotensin converting enzyme (ACE) inhibitor and potassium sparing diuretic (OR = 1.78; 1.48,2.15). In terms of evidence-based prescribing, the relatively deprived cohort with IHD was less likely to receive secondary prevention therapies such as statins (OR = 0.82; 0.74, 0.90) and beta blockers (OR = 0.85; 0.77, 0.93).

Conclusions
These results show that suboptimal prescribing is more prevalent among the relatively deprived cohort and suggests the differences observed in the quality of prescribing between these patient groups may be related to their socioeconomic status.

Introduction

The most frequent medical intervention performed by a doctor is the writing of a prescription [1] and of all activities in general practice, this has the greatest potential to produce health benefits or harm, the latter particularly in the elderly. The population of the developed world is steadily ageing and in the European Union (EU), there is a projected increase of about 27% in the older population by the year 2020 [2]. This has led to concerns regarding the increased demand on healthcare and its associated cost. The older population, being the major consumers and greatest beneficiaries of drug ther-

apy are particularly at risk of being exposed to drug-related problems, inappropriate prescribing and adverse drug reactions [1, 3, 4]. A substantial proportion of prescribing practice for the elderly is not consistent with appropriate care and inappropriate prescribing is a major cause of adverse drug reactions in the elderly [4].

Drug therapy is an integral part of health care, therefore some means of assessing quality prescribing is needed. Quality of prescribing has become an important issue in assessing the quality of health care in many countries, such as the United Kingdom, New Zealand, Australia and the United States, as health care providers and funders recognize the need for more objective measures [5–10].

The quality of drug prescribing has been measured through prescribing indicators [11] and there is some evidence to suggest that the socioeconomic status of a patient based on the neighbourhood income, influences generic prescribing and thus drug selection by physicians [12].

Differences in prescribing patterns, morbidity and mortality between socioeconomic groups have been well documented in the international epidemiological and sociological literature for many years [12–15]. Socioeconomic status has been shown to affect overall health status, with lower socioeconomic status associated with a decreased life expectancy and an increased prevalence of medical conditions [16].

From 1st July 2001, a change in the Irish government health policy ensured that all persons aged 70 years and over were eligible to join the General Medical Services (GMS) scheme in Ireland irrespective of income and thus receive free medical and pharmaceutical services. Prior to this, eligibility for the GMS scheme was determined by means testing of income with those outside the scheme responsible for the cost of their drugs and general practitioner services. The aim of the study was to compare the quality of prescribing, using prescribing indicators, between the relatively affluent patients over 70 years old (new to the GMS scheme in July 2001), and the relatively deprived over 70 year olds (already in the GMS scheme prior to July 2001) in the largest region in Ireland (Eastern Regional Health Authority (ERHA)) between July 2001 and December 2002.

Methods

Prescribing indicators reflecting good and bad prescribing practice in the elderly, obtained from a review of literature [4–7, 11, 17, 18], were applied to prescription data from the ERHA during the 18-month study period. The indicators that were chosen were applicable to an elderly population being treated in the community and could be easily identified using the prescription database. They were classified into three broad groups [6]:

(a) Indicators that were purely descriptive with no attempt to define an optimal value such as the number of prescription items per patient or volume of prescribing of antibiotics.
(b) Indicators that reflect potentially harmful prescribing, for instance the use of long-acting hypoglycaemics, drug interactions or unnecessary prescribing, e.g. duplication of therapy or drugs of limited clinical value (e.g. peripheral and cerebral vasodilators).

In order to examine the occurrence of drug interactions, a potentially harmful drug combination was identified by the co-prescription of such combinations within the same month. The combinations/drug interactions chosen were selected based on their clinical relevance and on the literature [4, 6, 17, 18].

(c) Indicators that assessed the appropriateness of prescribing specific drugs such as the prescribing of secondary prevention therapies such as statins in patients with ischaemic heart disease (IHD; identified using the co-prescription of nitrates and aspirin as a surrogate marker [19]).

Ireland is divided into eight regions for the administration of health services, with the ERHA being the largest region. The GMS provides free health service to approximately 350 000 persons in the ERHA in Ireland representing some 30% of the total population. The GMS prescription database accounts for approximately 70% of all medicines prescribed in primary care, with over representation of women, the young and the elderly, the latter group accounting for most of the prescribing [20]. Eligibility is confined to those who are unable without undue hardship to arrange general practitioner services for themselves and their dependants (e.g. a married couple aged 66 years or less with a weekly income limit of €200 or less) and for persons aged 70 years and over [21]. Prior to 1st July 2001, for married couples aged between 70 and 79 or aged 80 years and above, the means testing of income was based on a weekly income limit, which was set at €447 and €471, respectively. The prescription database records all prescriptions dispensed by any community pharmacy in the country operating within the scheme for claims purposes. It has been used to a large extent, due to its accuracy and large size, for research purposes to examine trends in prescribing. All medicines are dispensed to such patients without charge. All prescription items are coded according to the WHO Anatomical Therapeutic Classification (ATC) system [22].

The relatively deprived over 70-year-old patients were defined as those already in receipt of a GMS medical card prior to 1st July 2001. The relatively affluent were those aged 70 years or more who were new to joining the scheme from 1st July 2001 as a result of the change in the Irish government's health policy. Polypharmacy was defined as the concurrent use of five or more drugs by a patient.

The results are expressed as odds ratio (OR) adjusted for age and gender, and 95% confidence intervals using logistic regression and proportions (percentage prescribing) were compared using a Chi squared (χ^2) test. A *t*-test was used for comparison of means between the groups. All analysis was carried out using the SAS statistical software package version 8 (SAS Institute Inc. Cary, NC, USA). Significance at $P < 0.05$ is assumed.

Results

A total of 95 055 (M : F, 36 615 : 58 440) patients aged 70 years and above were identified using prescribing data from the ERHA (relatively deprived $n = 66\,521$; relatively affluent $n = 28\,534$). The relatively deprived patients received more prescriptions per head/month compared to the relatively affluent patients. Patients who were relatively affluent were prescribed a higher proportion of proprietary drugs (25%) in comparison to the relatively deprived patients (21.5%) and the deprived were more likely to receive generic (pure + branded) products (18.8%) compared with the affluent (13.8%) (Table 1).

A summary of the results from indicators assessing unnecessary or potentially harmful prescribing is shown in Table 2. In general, the relatively deprived cohort were more likely to receive potentially harmful drugs and drug combinations (OR = 1.27; 95% CI = 1.24, 1.31) in comparison to the relatively affluent cohort of patients.

Table 3 gives the adjusted odds ratio (age and gender) and 95% confidence intervals for the prescribing of secondary prevention therapies in both groups of patients and shows lower prescribing of statins and beta-blockers in the relatively deprived cohort.

Discussion

The older population tend to have greater morbidity compared with the rest of the population and as a result are prescribed more medications. The greater use of inappropriate drugs by the older population in particular carries an increased risk of adverse drug reactions because of the age-associated change in pharmacokinetics and pharmacodynamics [1]. The results of this study show a difference in both the quantity and quality of prescribing between the relatively deprived and the relatively affluent. This suggests that the socioeconomic status of a patient may influence the prescribing behaviour of physicians even when the influence of drug acquisition costs has been removed. Socioeconomic status has been found in some health care systems to have an influence on treatment selection by physicians in the elderly, with those on the highest income levels getting newer and more expensive branded drugs [12]. The use of levels of income prior to July 2001 is used as a surrogate for socioeconomic status in our study. However, this does not incorporate information on the levels

Table 1
Comparison of descriptive prescribing indicators between the relatively deprived and affluent cohorts (group a). Figures are percentages (number) of patients

Indicator	Relatively deprived cohort	Relatively affluent cohort	*P*-value
Mean (±SD) number of prescription items/patient	5.20 (± 4.96)	4.51 (± 3.04)	<0.0001
Received ≥five drugs	45 (29 624)	35 (10 092)	Adjusted odds ratio 1.58 (1.52,1.64)***
Received one drug	15 (9660)	19 (5286)	*P* < 0.0001
Percentage of pure generic	4.82	3.3	*P* = 0.01
Percentage of branded generic	13.9	10.5	
Antibiotic prescribing	61 (40 565)	55 (15 650)	Adjusted odds ratio 1.26 (1.23,1.30)***

SD = standard deviation. ***P < 0.001*

Table 2
Indicators assessing drugs of limited clinical value, potentially harmful prescribing (group b). Figures are percentages (number) of patients

Drugs	Relatively deprived cohort	Relatively affluent cohort	Adjusted odds ratio (95%CI)
Cerebral vasodilator	3 (1716)	2 (493)	1.52 (1.38, 1.69)***
Long-acting (LA) sulphonylurea	0.8 (509)	0.6 (157)	1.43 (1.20, 1.72)***
Duplication of therapy (PPI + H_2 antagonist)	1.4 (935)	0.8 (241)	1.68 (1.46, 1.94)***
High risk NSAID (piroxicam, ketoprofen)	1.3 (876)	1.3 (362)	1.14 (0.84, 1.55)^{NS}
Thioridazine	0.7 (438)	0.3 (100)	1.83 (1.47, 2.28)***
Cimetidine	3 (2023)	1.8 (507)	1.75 (1.58, 1.92)***
†Indomethacin	1.0 (654)	1.1(306)	0.96 (0.84, 1.10) ^{NS}
†Amitryptilline	2 (1457)	1.8 (524)	1.16 (1.05, 1.29)**
†Doxepin	0.2 (149)	0.2 (63)	1.01 (0.76, 1.36) ^{NS}
†LA benzodiazepine	17 (11 043)	14 (4057)	1.17 (1.12, 1.21)***
Diazepam	10 (6932)	8 (2326)	1.27 (1.21, 1.34)***
NSAID + diuretics	16 (10 790)	12 (3399)	1.39 (1.27, 1.45)***
NSAID + warfarin	1.9 (1241)	1.7 (477)	1.15 (1.03, 1.28)**
NSAID + aspirin	17 (11 004)	16 (4531)	1.05 (1.01, 1.09)*
Aspirin + warfarin	1.7 (1101)	1.8 (514)	0.96 (0.86, 1.07)^{NS}
ACE inhibitor + potassium sparing diuretics	0.8 (548)	0.4 (139)	1.78 (1.48,2.15)***
Proportion of patients prescribed at least one potentially inappropriate drug combination	26.85 (17 861)	23.72 (6772)	$P < 0.0001$

*†Beers criteria; NSAID = nonsteroidal anti-inflammatory drug; PPI = proton pump inhibitor; H_2 antagonist = histamine receptor II antagonist; *P < 0.05, **P < 0.01, ***P < 0.001; NS = not statistically significant.*

Table 3
Indicators assessing appropriateness of prescribing, evidence based (group c). Figures are percentages (number) of patients

Drugs	Relatively deprived	Relatively affluent	Adjusted odds ratio (95% CI)
Low risk NSAID (ibuprofen, diclofenac)	18 (12 219)	16 (4637)	1.16 (1.12, 1.20)***
IHD patients	11 (6979)	8 (2184)	–
IHD patients receiving:			
beta blockers	49 (3440)	54 (1172)	0.85 (0.77, 0.93)***
Statins	43 (2987)	48 (1045)	0.82 (0.74, 0.90)***

IHD = ischaemic heart disease.

of education of individuals and it may be that some elderly patients in our study who are on lower incomes may have been well educated.

Furthermore, the relatively affluent cohort with IHD was more likely to receive secondary prevention therapies (statins and beta-blockers) compared to the relatively deprived cohort. Subgroup analyses of elderly cohorts (≥65 years) in the Scandinavian Simvastatin Survival Study (4S) and the Cholesterol and Recurrent Events (CARE) trial (60–80 years) have shown beneficial effects of statin therapy in the elderly. However, more recently, results from the Heart Protection Study and the PROSPER study, which recruited more than 5000 individuals over 70 years of age, also indicate that the cardiovascular benefits from statin administration are as strong in elderly as in younger individuals [23,

24]. However, the benefits of prophylactic treatment will, in general, decrease with advancing age for reasons such as lower compliance, the potential for adverse drug events and interactions with polypharmacy.

Socioeconomic deprivation has been shown to have a profound effect on the risk of having a first myocardial infarction, the chance of reaching hospital alive and the probability of surviving the first month [25]. Socioeconomic group not only affects death rates from myocardial infarction but also event rates and chance of admission to hospital [26]. Following on from this, one would expect to see a higher rate of prescribing of secondary prevention therapies in our cohort of relatively deprived patients in order to improve their chances of survival, however, this was not the case.

Antibiotic prescribing in general practice is often considered inappropriate and its volume excessive. Because of its effects on both morbidity and patient/doctor expectation, socio-economic deprivation is often considered to be a particularly important factor encouraging the prescribing of antibiotics, with higher antibiotic prescribing associated with increased deprivation [27], however there is little evidence to support this. This finding was reflected in our study, with the relatively deprived cohort being more likely to receive a prescription for an antibiotic compared to the affluent cohort.

The most widely used set of explicit criteria for assessing inappropriate drug use and hence quality of prescribing in the elderly is the Beers criteria [18, 28]. Explicit criteria (inappropriate drugs and drug combinations) also serve as prescribing indicators, because they can be used as objective measures of prescribing, thus allowing comparison between different prescribers. Also, they can easily be applied to population-based studies in order to identify areas for improvement. One limitation of using Beers criteria is that it was developed for use in the United States, therefore some of the drugs listed are not available in Ireland. A recent review of the Beers criteria updates the existing criteria to take into account new products on the market and new indications, and assigns a severity rating to the various criteria [29]. The indicators used in this study employed the use of 'index' or specific drugs to identify inappropriate prescribing. Where drugs such as long-acting benzodiazepines (e.g. diazepam, which has a long half life in the elderly thus producing prolonged sedation and subsequently an increased risk of falls and fractures) or long-acting sulphonylureas (which are associated with increased risk of hypoglycaemia and coma in the elderly) have been identified as being inappropriate or to be avoided in the elderly, the prescription of such a drug would indicate suboptimal prescribing, especially when shorter acting alternatives are available.

Polypharmacy was more likely to occur in the relatively deprived patients compared with the affluent patients. This was expected because the deprived patients received more prescriptions per month compared to the affluent patients. While polypharmacy may be a necessity in the management of some medical conditions such as heart failure and IHD, research has shown that when the number of concurrently used drugs exceeds five, there is an increased risk of adverse drug events [30]. These risks include duplication of therapy, which was seen more commonly in the relatively deprived compared to the affluent cohort and also a higher proportion of the deprived cohort was exposed to at least one potentially harmful drug combination compared to the affluent group. In particular, the deprived cohort were more likely to be co-prescribed an angiotensin converting enzyme (ACE) inhibitor and potassium sparing diuretics, exposing such patients to the risk of hyperkalaemia. This combination is potentially hazardous because it may cause cardiac arrest and subsequently death.

The exact reasons for the difference in quality of prescribing observed in our study population is difficult to explain because all drugs prescribed to GMS patients by a general practitioner operating within the scheme are supplied to the patient free of charge irrespective of income. The differential observed between the deprived and affluent cohorts may reflect the differing influence of free medicines on prescribing practice between the cohorts, rather than the income level of the patient, but we have no evidence to suggest this. There is a higher capitation fee paid to the GP for the relatively affluent (€480.66) compared to the relatively deprived (€114.4).

Other factors such as patient demand and expectations, education and knowledge about their health may also influence prescribing behaviour. Patients requests for drugs has been reported to be a powerful influence on a GP's decision to prescribe a new drug [31] and this can be related to the level of education and the fact that patients of higher socioeconomic status may have greater access to information sources on health [12, 31].

There are, however, limitations to our study. Our prescription database does not contain information on patient diagnosis nor do we have information on other potential risk factors such as comorbid illness, etc. However, the database comprises large numbers of patients and use of such a database may be said to reflect real life usage of medicines. In addition to providing details on prescription claims, prescriptions also contain demo-

graphic data such as age and gender. The database cannot account for the use of over-the-counter (OTC) therapies in addition to prescribed therapies. Patients covered under the GMS, however, are obliged to pay for nonprescription items. Thus there is a strong financial incentive not to comedicate with OTC therapies. It is likely, therefore, that usage is small and bias would be minimal.

Conclusion

The relatively deprived cohort tended to receive more drugs, which may in part be attributable to greater morbidity, but the choice of agents of questionable value or greater potential for toxicity and the lower prescribing of secondary prevention therapies may indicate less appropriate prescribing in this group of patients. However, no extrapolation to overall quality of care should be made based on the results of this study because prescribing indicators do not provide definitive answers, they only indicate potential problems.

We would like to thank the General Medical Services (Payments) Board for supplying us with the data on which this study is based, and the Health Research Board for funding.

References

1 Rochon P, Gurwitz JH. Optimising drug treatment for elderly people: the prescribing cascade. BMJ 1997; 315: 1096–9.

2 Buckley BM. Healthy ageing: ageing safely. Eur Heart J 2001; 3(Suppl. N): N6–10.

3 Hanlon JT, Schameder KE, Boult C, Artz MB, Gross CR, Fillenbaum GG, Ruby CM, Garrad J. Use of inappropriate prescription drugs by older people. J Am Geriatrics Soc 2002; 50: 26–34.

4 Straand J, Rokstad KS. Elderly patients in general practice: diagnoses, drugs and inappropriate prescriptions. A report from the Møre and Romsdal Prescription Study. Family Prac 1999; 16: 380–8.

5 Bateman DN, Eccles M, Campbell M, Soutter J, Roberts SJ, Smith JM. Setting standards of prescribing performance in primary care: use of a consensus group of general practitioners and application of standards to practices in the north of England. Br J Gen Prac 1996; 46: 20–5.

6 Oborne CA, Batty GM, Maskey V, Swift CG, Jackson SHD. Development of prescribing indicators for elderly medical inpatients. Br J Clin Pharmacol 1997; 43: 91–7.

7 Campbell SM, Cantrill JA, Roberts D. Prescribing indicators for UK general practice: a Delphi consultation study. BMJ 2000; 321: 1–5.

8 Gribben B, Coster G, Pringle M, Simon J. Quality of care indicators for population based primary care in New Zealand. N Z Med J 2002; 115: 163–6.

9 Robertson J, Fryer JL, O'Connell DI, Smith AJ, Henry DA. Limitations of Health Insurance Commission (HIC) data for deriving prescribing indicators. Med J Aust 2002; 176: 419–24.

10 Knight EL, Avorn J. Quality indicators for appropriate medication use in vulnerable elders. Ann Intern Med 2001; 135: 703–10.

11 Lawrence M, Olesen F. Indicators of quality in health care. Eur J Gen Pract 1997; 3: 103–8.

12 Mamdani MM, Tu K, Austin PC, Alter DA. Influence of socioeconomic status on drug selection for the elderly in Canada. Ann Pharmacother 2002; 36: 804–8.

13 Worral A, Rea J, Ben-shlomo Y. Counting the cost of social disadvantage in primary care: retrospective analysis of patient data. BMJ 1997; 314: 520–3.

14 Hays DI. Socioeconomic status and health status: a study of males in the Canada health survey. Soc Sci Med 1998; 27 (12): 1317–25.

15 Knesebeck O, Luschen G, Cockerham WC, Siegrist J. Socioeconomic status and health among the aged in the United States and Germany: a comparative cross-sectional study. Soc Sci Med 2003; 57: 1643–52.

16 Kunst AE, Groenhof F, Makenbach JP. The EU Working Group on Socioeconomic Inequalities in Health. Occupational class and cause specific mortality in middle aged men in 11 European countries: comparison of population based studies. BMJ 1998; 316: 1636–41.

17 Beers MH. Explicit criteria for determining potentially inappropriate medication use by the elderly. Arch Intern Med 1997; 157: 1531–6.

18 British National Formulary (BNF) – Number 45. Pharmaceutical Press, Oxford, UK, March 2003.

19 Gray J, Majeed A, Ferry S, Rowlands G. Identifying patients with ischaemic heart disease in general practice – cross sectional study of paper and computerised medical records. BMJ 2000; 321: 548–50.

20 Feely J, Chan R, McManus J, O'Shea B. The influence of hospital based prescribers on prescribing in general practice. Pharmacoeconomics 1999; 16: 175–81.

21 General Medical Services (Payments) Board. Annual report for the year ended 31st December 2002.

22 WHO. Collaborating Centre for Drug Statistics Methodology (ATC Index with DDDs). Oslo, Norway 2003.

23 Heart Protection Study Collaborative Group. MRC/BHF Heart protection Study on cholesterol lowering with simvastatin in 20,536 high risk individuals: a randomised placebo controlled trial. Lancet 2002; 360: 7–22.

24 Shepherd J, Blauw GJ, Murphy MB, Bollen EL, Buckley BM, Cobbe SM, Ford I, Gaw A. Pravastatin in elderly individuals at risk of vascular disease (PROSPER): a randomised controlled trial. Lancet 2002; 360: 1623–30.

25 Macintyre K, Stewart S, Chalmers J, Pell J, Finlayson A, Boyd J, Redpath A, McMurray J, Campbell S. Relation between socioeconomic deprivation and death from a first myocardial infarction in Scotland: population-based analysis. BMJ 2001; 322: 1152–3.

26 Morrison C, Woodward M, Leslie W, Tunstall-Pedoe H. Effect on socioeconomic group on incidence of, management of, and survival after myocardial infarction and coronary death: analysis of community event register. BMJ 1997; 314: 541.

27 Wilson RPH, Hatcher J, Barton S, Walley T. The Association of Some Practice Characteristics with Antibiotic Prescribing. Pharmacoepidemiol Drug Safety 1999; 8: 15–21.

28 Aparasu RR, Mort J. Inappropriate prescribing for the elderly: Beers criteria-based review. Ann Pharmacother 2000; 34: 338–46.

29 Fick DM, Cooper JW, Wade WE, Waller JL, Maclean JR, Beers MH. Updating the Beers criteria for potentially inappropriate medication use in older adults. Arch Intern Med 2003; 163: 2716–24.

30 Field TS, Gurwitz IH, Avorn J, McCormick D, Jain S, Eckler M, Benser M, Bates DW. Risk factors for adverse drug events among nursing home residents. Arch Intern Med 2001; 161: 1629–34.

31 Prosser H, Almond S, Walley T. Influence on GP's decision to prescribe new drugs – the importance of who says what. Family Prac 2003; 20: 61–8.